

OCEANOGRAPHY AND MARINE BIOLOGY, A BOOK OF TECHNIQUES. By H. Barnes. George Allen and Unwin Ltd., London. 1959. 218 pp., illus. 35s.

The world beneath the ocean surface is remarkably inaccessible to direct observation by men. In consequence, marine scientists have had, perforce, to develop apparatus for studying indirectly the waters of the ocean and their contents. During the last few decades, especially, physical and chemical oceanographers, geologists, biologists, and fishery scientists have brought forward a vast array of new equipment and ingenious techniques. A comprehensive description of this equipment and methodology would be extremely useful, both as a text for students and a reference work for researchers. Unfortunately, this small volume meets this need only to a minor degree.

Dr. Barnes' book contains four brief chapters. Under *Sampling of the Living Organisms* he describes some of the apparatus and methods of collecting and measuring bacteria, nanoplankton, and diatoms in water samples, provides a brief discussion of plankton nets and pumps, and gives a rather detailed discussion of the construction and use of the Hardy plankton recorder and related apparatus. There are also descriptions of various types of trawls, dredges, and bottom "grab" samplers, together with description of coring devices, both gravity and piston-types. This, except for the subsequent material on bottom photography, is the only mention of the equipment and techniques of submarine geology; there is no mention of magnetometers or gravimeters, nor of the techniques of seismic research.

The chapter on *Use of Sound Waves* describes the principles of echo sounders, illustrates their use in commercial fishing and fisheries research, and discusses briefly studies of the deep scattering layers. A short section is devoted to underwater sounds of biological origin.

The chapter on *Some Properties of the Water Itself* describes the classical apparatus for measuring temperatures and for taking water samples: bucket thermometers, the Lumby surface sampler, insulated and reversing water bottles, reversing thermometers, the Mosby thermosound, and the Spilhaus bathythermograph (which is called a "new" instrument, although it has been in wide use for over a decade) and the related sea-sampler. Resistance thermometers, thermistors, and conductivity cells are dealt with in two sentences. Current measurements are discussed under two headings—drift methods and flow methods. Under the former are discussed various kinds of drift bottles and drift cards, and tracking of buoys. Under flow methods are described various impeller-type current meters, such as those of Ekman, Carruthers, and Von Arx, the Jacobsen current drogue, and the geomagnetic electrokinetograph. There is no mention of apparatus and techniques of the study of waves and swell, of turbulence and diffusion, nor of light in the sea.

A final chapter on *Photography and Television* includes an excellent description of the application

of aerial photographic methods to beach profiles and determination of near-shore water depths, a good description of some underwater camera equipment, and an illuminating discussion of underwater television apparatus.

This book will be of interest to general readers and of value, as an introduction to oceanographic and marine-biological methods, to students of oceanography and fisheries. The author apparently did not intend it to be a comprehensive reference work for research oceanographers, despite the jacket blurb, since he is also preparing a more comprehensive treatise on *Apparatus and Methods of Oceanography*, of which *Part One: Chemical* was also published during 1959 by Interscience Publishers, New York.

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RAINBOW TROUT IN MEXICO AND CALIFORNIA, WITH NOTES ON THE CUTTHROAT SERIES. By Paul R. Needham and Richard Gard. (University of California Publications in Zoology, Vol. 67, No. 1, pp. 1-124, 8 plates, 40 figs., 3 maps). University of California Press, Berkeley, Calif. 1959. \$2.50.

There has been controversy for years concerning the taxonomy of the rainbows, and this is a timely attempt to clarify the situation. Owing to the extinction of some races and numerous widely-scattered hatchery plants, it is perhaps too late to ever know what many of the original stocks were. This same obstacle undoubtedly made it nigh impossible to obtain large samples of native fish.

This paper utilizes 12 meristic counts and 28 body proportions in comparing populations of trout designated as rainbows taken from Eagle Lake in northern California to the Rio del Presidio in Sonora, Mexico. Nevertheless, we regard this paper as qualitative owing to the paucity of material—306 specimens from 17 localities, or an average of 18 per locality, actually ranging from 2 to 30 fish per locality, collected over 30 years, and extending over 1,000 miles of territory. This same paucity of material is evident in Table 4 giving water temperatures in Mexican localities. Fifteen water temperatures taken during 5 months in two different summers and accompanied by only eight air temperatures, are scarcely worth recording.

The statistical methods employed may not be efficient. Regression analysis of body proportions was omitted, the "thousandths of standard length" being treated in a manner similar to meristic counts, despite the very small sample numbers, the considerable variation in fish size, and no evidence that the plots of standard length and the various measurements pass through the origin and are linear throughout the length range.

The authors assumed that the populations are all "rainbows," but on page 47 they mention the faint yellowish "cutthroat" mark of the trout from the Rio Yaqui in Sonora, Mexico, which de Buen in 1947 classified as Rio Grande cutthroats. Again on page 51 they say of the trout they style the Mexican golden trout, "These are beautiful fish and their dominant feature, when alive, is the bright orange 'cutthroat' color below the jaw and on the belly."

It is well known that cutthroats often have the colored lateral band and I have observed the "strong orange of the lower fins" (page 57) and the rosy color which they quote from Flechsig's field notes, "orange-red of ventrum does not extend up above lower bases of the paired fins. Rosy color is well developed between the parr marks," on cutthroats but never on rainbows. This exemplifies the difficulty of working with old preserved material when the principal identifying character is a genetic color pattern. This is also evident from the authors' color descriptions as "badly faded," page 59; the Rio Culiacán collection "closely resemble the Sinaloa rainbows after preservation," page 57; "these 8 specimens have faded to a dull brown . . . the rainbow stripe has completely disappeared," page 36.

A few contradictions are curious. On page 45 the authors (after not worrying about the underjaw "cutthroat" coloring) are upset by finding one specimen (out of 25) in the Santo Domingo River, Baja California, with three *well-developed* basibranchial teeth. They say, ". . . it gave no hint of other cutthroat characteristics. Hybridization with sea-run cutthroat could have occurred earlier, and this fish could represent the result of a rare recombination of genes or a gene mutation suddenly producing this character." After calling the Rio Yaqui trout "rainbows" on page 47, they state on page 64 that, "The possession of a faint, yellowish 'cutthroat' mark by the Black Canyon and Casas Grandes rainbows could reflect hybridization with the Rio Grande cutthroat . . ."

On page 59 the authors conclude that Stilwell was misinformed concerning the planting of hatchery rainbows in the Rio Truchas, but on page 64 the authors say, "If it is true, as Stilwell (1948, p. 135) states, that English immigrants introduced rainbow trout into northwestern Mexico, the Black Canyon and Casas Grande populations could represent hybrids not only between the Rio Grande cutthroat, but also between the Gila trout or some other form of rainbow."

The "coefficient of difference" used by the authors is a "cookbook" method devised to replace standard statistical procedures. According to this method the vertebral counts of localities are compared (p. 34) in which even the extreme ranges of the counts do not overlap and yet they cannot decide whether or not the two populations overlap!

The authors prefer to ignore the present nomenclatorial procedure of dropping the extra *i* in the genitive case of proper names denoting species.

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HANDBOOK OF COMPUTATIONS FOR BIOLOGICAL STATISTICS OF FISH POPULATIONS. By William E. Ricker. (Fisheries Research Board of Canada, Bulletin No. 119). The Queen's Printer, Ottawa. 1958. 300 pp., 44 figs. \$5.00.

This is a revised and greatly enlarged outgrowth of the author's earlier work, *Methods of Estimating Vital Statistics of Fish Populations* (1948), affectionately known by fishery workers everywhere as "The Green Monster." The revision presents a wealth of measurement theory and technique, the enormity of which defies comprehensive review. Compiled by one of the world's leaders in the field of population dynamics, the contents touch upon all problems commonly encountered in estimating fish population parameters. A wide variety of worked examples using hypothetical and actual data facilitates the application and solution of formulas derived by the author or drawn from a vast but scattered literature. Sources of estimation bias are recognized and, where possible, accounted for through appropriate data adjustment.

This is not a textbook, but strictly a handbook as the title indicates, and it will prove most useful to the more advanced student or researcher. The user must be familiar with the vagaries of natural populations, the intricacies of sampling theory, and the nature of variability. A working knowledge of the structure of modern fishing theory is also implied. Such previous understanding is indeed a formidable barrier to most biologists and the lack of it is frequently circumvented through acceptance at face value of measurement techniques that may not be appropriate in given situations. Unfortunately, the author did not devote more space to developing, in elementary terms, the theory referred to above. For the average biologist this would have meant enhancement of the book's over-all value and, conceivably, curtailment of indiscriminate "cook-book" application of techniques. Instead, the author plunges abruptly into a glossary of complex terms and symbols, many of which have been shown to have highly ambiguous meanings. [Note: An attempt to standardize terms and symbols has been made by the Conseil Permanent International pour l'Exploration de la Mer (1959).] Following a rather brief discussion of parameters (*i.e.*, mortality, growth, and reproduction), he then considers in relatively great detail the interpretation and use of "catch curves" in estimating survival, and hence total mortality, in *defined* populations. Much of this discussion relies upon hypothetical examples in which certain factors, particularly recruitment, are either fixed or allowed to vary. This conditional approach illustrates what theoretically happens in nature; but is of little aid to the biologist struggling to estimate, say, actual recruitment, and hence recruitment-yield-stock relationships. The point here is that too much emphasis is frequently placed on the hypothetical mechanics of accepted and well-documented theory, and not enough on the real problems of establishing the conditions necessary to implement the theory and, just as important, of acquiring the data for computing the statistics it is designed to yield.

Chapters on mark-recovery experiments; uses of catch statistics to assess populations and various characteristics thereof; yield prediction; stock-progeny relationships; and the concept of equilibrium yield complete the handbook. Those describing